

BRUSHWELLMAN
ENGINEERED MATERIALS

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June 12, 1987

Ms. Sue Linner
Permit Supervisor
Utah Division of Oil, Gas and Mining
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Dear Sue:

Delivered herewith are four (4) copies of a DRAFT version of Brush's Revised Reclamation Plan previously submitted on January 12, 1987. Please note that all changes are made in bold type. The DRAFT version contains Brush's technical response to DOGM's staff comments contained in your letter of March 30, 1987. The DRAFT version also contains other changes in the Revised Reclamation Plan as we agreed during our May 18, meeting with you and your staff.

We do not consider the DRAFT version a replacement of the January 12, 1987 revised plan. We are submitting it to allow you and your staff the opportunity to review the response and changes prior to our scheduled site visit on Tuesday, June 23, 1987. To ensure that the review takes up a minimum of your time, we have prepared a cross reference list which correlates DOGM staff comments of March 30 with Brush's technical responses contained in the DRAFT version of the plan. Following the site visit and receipt of any additional comments that you and your staff may have, we will prepare and submit to the Division, an updated version which will permanently replace the January 12, 1987 Revised Reclamation Plan.

The changes made as a result of your comments of March 30 and our meeting of May 18, involved revisions in overburden handling practices and deal primarily with the treatment of backfilled pit surfaces that will not be topsoiled. Tuff overburden will not be spread over backfilled pits but deposited within a small portion of the backfilled area. The small areas (cells) used for depositing the tuff will be covered with rhyolite as described in the DRAFT version. Please note that certain sediment control berms have been eliminated in the draft because our recent examination of the outslopes of these dumps indicates the outslopes are rhyolite, not tuff.

Sincerely yours,

BRUSH WELLMAN INC.



Kenneth R. Poulson

Vice President
Mining & Exploration

KRP/dt

CROSS REFERENCE LIST FOR
DOGM, MARCH 30, 1987 STAFF COMMENTS AND
BRUSH WELLMAN'S JUNE 12, 1987 TECHNICAL RESPONSE
AS CONTAINED IN THE DRAFT VERSION OF
BRUSH'S REVISED RECLAMATION PLAN

<u>Staff Comment</u>	<u>Addressed in Revised Plan on:</u>	
	<u>page</u>	<u>section</u>
Variance Requests	pp. 16 & 17 p. 24 p. 32 p. 33 p. 45 & 46	Section 3.4 Section 4.3 Section 4.3 Section 4.3 Section 4.6
Rule M-3 - JRH	will be addressed in final plan version	
Rule M-3 (1)(d) - RPS	p. 4 p. 8 p. 42 also Plates 2.0-1 and 2.2-1	Section 1.1 Section 2.3 Section 4.5
Rule M-3 (1)(d) - DD	pp. 9 & 10	Section 2.5
Rule M-3 (1)(e) - RPS	addressed after field visit as per DOGM	
Rule M-3 (2)(e) - LK	addressed after field visit as per DOGM	
Rule M-3 (2)(f) - LK	p. 55	Section 7.0
Rule M-3 (h) - RPS	pp. 9 & 10	Section 2.5
Rule M-5 Bonding Reqs. - JRH	to be submitted following plan approval	
Rule M-5 and M-10 Maps - JRH	no plan change necessary	
Rule M-10 (2)(b) - JRH	p. 40 & 41	Section 4.4
Rule M-10 (4) - JRH	p. 24	Section 4.3
Rule M-10 (5) - JRH	p. 30 & 32	Section 4.3
Rule M-10 (7) - RPS	p. 41	Section 4.5
Rule M-10 (11) - RPS	addressed after field visit as per DOGM	

CROSS REFERENCE LIST/ page 2

Staff Comment

Addressed in Revised Plan on:
page section

Rule M-10 (12) - LK

p. 45 & 46 Section 4.6

Rule M-10 (14) - JSL

p. 22 Section 4.3

p. 33 Section 4.3

p. 43 Section 4.6

also new Plate 4.3-2

Introduction

Brush Wellman, Inc. has been involved in the Topaz Mining Property since the discovery of beryllium ore in 1959. The first pit was opened in 1968 and the mill near Lyndyll began operation in 1969. Since that time these operations have been continuously active. In compliance with the Utah Mined Land Reclamation Act, Brush Wellman filed a complete Notice of Intention and Mining and Reclamation Plan with the Division of Oil, Gas and Mining (DOGM) in March 1977. The Division granted tentative approval for the plans in 1977 and again in April 1981, following the submission of additional information by Brush. The Reclamation Plan approved by the Division generally consisted of covering the dumps with volcanic tuff removed from the pits and revegetating with a seed mix that was to be verified with revegetation test plots.

The approved revegetation plan was therefore contingent on test plot studies that were designed by the DOGM in 1977 and initiated by Brush Wellman in 1978. To reclaim the large dumps of rhyolite overburden material, the Division suggested that these dumps be covered with the fine-grained volcanic tuff. This material was sampled by the Division for determination of its potential as a topsoil substitute. The test plots were then designed to evaluate various seedbed preparations and plants for revegetating directly into the tuff material. In the interim, Brush has followed the recommended plan of covering all dump areas with the tuff

material. Since the test plot program was never evaluated or checked by the DOGM, finalization of the reclamation plan remained an unresolved issue and final approval of the application, including reclamation bonding was pending. In 1985 the Division requested that Brush proceed with finalizing the reclamation plan as well as estimating the reclamation bond.

The test plots, although continuously maintained, were not systematically evaluated by Brush until 1985 and were found to have generally failed to provide a suitable means to revegetate the tuff material. It then became apparent that the previously approved reclamation plan would be impossible to successfully implement. Therefore, Brush has prepared this reclamation plan revision for the reclamation of its mining property.

This proposed reclamation plan revision is intended to provide a reasonable solution to the revegetation of some of the disturbed areas and provide sediment control on sites that cannot be revegetated. The plan is based on the test plot results, baseline soils and vegetation data secured in 1985 and a review of the literature as it applies to similar environments. Enclosed with this plan are three separate reports on revegetation test plots, vegetation and soils that provide the background information and support for this reclamation plan. These reports are titled:

Report on Revegetation Test Plot Program, Brush Wellman Inc., Topaz Mining Property, JBR Consultants Group, 1985.

Report on Plant Communities, Brush Wellman Inc., Topaz Mining Property, JBR Consultants Group, 1985.

Report on Investigations of Soils, Brush Wellman Inc., Topaz Mining Property, JBR Consultants Group, 1986.

On March 22, 1978 Brush submitted a completed Commitment To Rule M-10 (MR Form 8) in which it committed to full compliance with all provisions of Rule M-10. It has since come the attention of Brush that full compliance with Rule M-10 is not possible at its mining properties and, in fact is inconsistent with its approved Mining and Reclamation Plan. Therefore Brush will submit a separate request for variances from certain portions of Rule M-10. References to the variances, pointing out the reasons for the separate request, are included in this revised Reclamation Plan

1.0 Environment

1.1 Climate

The Topaz Mining Property is located in the Thomas Mountains-Tintic Mountains subdivision of the Basin and Range Physiographic Province at an elevation of 4600-5000 feet. The climate is cool continental and very arid with a net evaporation loss. Annual precipitation is 6-8 inches. Most precipitation comes as spring rains and summer showers, consequently the growing season is confined to the late spring and intermittent summer periods.

As a result of the low precipitation and small watershed areas of natural drainages in the mine area, all drainages are ephemeral. Other than water accumulated by runoff in the mine pits and minor accumulations that occasionally occur after major rainfall events behind dumps blocking drainages, there are no surface water empoundments in the area.

1.2 Land Use

The pre-mining land use was grazing and wildlife habitat. The grazing use was primarily winter and spring sheep grazing. Wildlife use is confined to small mammals, birds, raptors and antelope year-long range.

1.3 Soils

The soils are derived chiefly from rhyolite and lesser amounts of limestone. The soils in the hills are shallow and very stony. The soils of the lower valley slopes are relatively undeveloped layers of alluvium, chiefly sandy gravels and sandy loams. These soils are generally classified as saline soils (see attached report: Report on Investigations of Soils, Brush Wellman Inc., Topaz Mining Property JBR, 1986) Soil profiles and fertility analysis are described in Appendix I.

1.4 Vegetation

Vegetation is of the cold desert biome. Two desert shrub communities occupy the properties; the hill community has a grass understory and is located on the shallow stony loam soils, while the shrub community on the alluvial soils has a mixed grass-forb understory. Total ground cover varies from 24% on the alluvial slopes community to 37% on the hill community (See attached Report on Plant Communities, Brush Wellman Inc., Topaz Mining Property, JBR, 1985).

2.0 Existing and Proposed Mine Operations

2.1 Pit Complexes

The Brush Wellman mining operations consist of a number of separate open pits with adjacent overburden mine dumps. The mining methods utilized were described in detail in Brush's previous application materials. These mining methods have not been changed and therefore will not be described further in this revision document.

There are eight existing open pits and nineteen proposed pits in the mine plan. Plate 2.0-1 shows the locations and configurations of the present and proposed pits and dumps, including their ultimate acreages. The sequence of pit operations is described in Table 2.1-1 indicating the year in which each pit is presently scheduled to be opened.

2.2 Roads

The majority of the present system of roads and ways existed in the area prior to the exploration and development of the Topaz Mining Property. Some of these existing roads have been upgraded and utilized in the development and operation of the mines and still serve as access roads for other land users. During the course of its operations, Brush develops minor lengths of new roads to connect the pits with the existing roads. All of these existing and proposed roads

<u>Existing Pits</u>	<u>Year Opened</u>
Roadside I	1968-69
Blue Chalk North #1	1971-72
Fluro #1	1974-75
Taurus	1979
Sigma-Emma	1979-80
Roadside II	1981
Rainbow #1	1985
Blue Chalk South #1	1985-86

<u>Proposed Pits</u>	<u>Year Presently Scheduled to be Opened</u>
Roadside/Fluro #3 & #4	1988 & 2004 1989
Section 16 N#1,S#1,N#2,S#2,N#3	1989 , 1998, 2005, 2009, 2030 1994
Monitor #1,#2,#3	1993, 2001, 2016
Blue Chalk South #2,#3	1994 & 2017
Rainbow #2,#3	1997 & 2012
Blue Chalk North #2,#3	2002 & 2013
Fluro #2	2008
Camp #1	2020
Southwind #1	2024

which will be utilized by Brush are shown on Plate 2.2-1. Plate 2.2-1 indicates which of the roads (new roads constructed by Brush) will be reclaimed. All other roads will be turned over for their continuing uses. The reclamation plans for the roads are described in Section 4.4 of this document.

2.3 Structures

The mine camp area consists of mobile homes and metal buildings. The metal buildings are on concrete pads. There is a second camp area utilized intermittently by earth-moving contractors during open-pit construction. The second area is utilized by a contractor for mobile home sites and maintenance shops. The reclamation plans for these areas are described in Section 4.4 of this document. The locations of the camps are shown on the map entitled Acreage of Current and Proposed Areas of Disturbance that was submitted to the Division on May 17, 1985. That submittal is included herein as part of Appendix _____. There are no utility transmission lines in the mine vicinity.

2.4 Disturbed Acreage

The total disturbed acreage for the permit includes both lands disturbed since 1968 and lands forecast to be disturbed through 2034. Table 2.4-1 is a summary of the total acreage to be disturbed. Table 2.4-1 lists the present

Table 2.4-1 Disturbed Acreage, Existing and Proposed

<u>Pit Complexes</u>	<u>Pits</u>		<u>Dumps</u>	
	<u>Existing</u>	<u>Proposed</u>	<u>Existing</u>	<u>Proposed</u>
Roadside	56.6	-	113.6	-
Blue Chalk North	19.6	17.9	24.4	B
Blue Chalk South	29.7	22.8	69.0	-
Fluro	22.6	19.1	64.9	*
Sigma Emma	26.7	-	69.4	-
Taurus	13.2	-	33.3	-
Rainbow	34.9	26.5	58.0	B
Roadside/Fluro	-	36.5	-	B
Section 16 North	-	47.2	-	B
Section 16 South	-	19.0	-	71.0&B
Monitor	-	68.7	-	82.5
Camp	-	17.1	-	30.5
Southwind	<u> </u>	<u>24.2</u>	<u> </u>	<u>39.3</u>
Totals	203.3	299.0	432.6	223.3
<hr/>				
Total Pits and Dumps - Existing				635.9
Total Pits and Dumps - Proposed				522.3
Roads (Existing = 7.1, proposed = 5.7)				12.8
Camps (Existing)				<u>18.0</u>
<u>Total Acres Disturbed</u>				1189.0

B Waste goes into backfilling existing pits

* Dump is superimposed on existing dump

disturbed acres of pits, dumps, roads and camps at 661 acres. Future, additional disturbed acreage totals 528 acres for a sum total of 1189 acres.

2.5 Water Use and Water Quality

Water accumulates by rainfall runoff in some open pits on the mine property. The amount of accumulation is a function of the pit area, rainfall amounts, and evaporation rate. The beryllium ore zone occurs within a tuff horizon which is largely made up of clay. The major clay mineral in the tuff is montmorillonite, which expands in the presence of water. Therefore, the pit floors, both before final stripping and following ore removal, are lined with a thick layer of impermeable material. Brush's mining experience demonstrates that following removal of water standing on tuff-floored pits, the clay just a few inches below the surface is dry. Therefore, infiltration of runoff water is virtually non-existent. The risk to adverse affects on groundwater from pit water infiltration is further mitigated by the fact that the quality of the runoff water in the pits is, as discussed below, apparently better than that of the local groundwater.

Water samples were taken from the Taurus, Sigma Emma, Roadside I & II and Fluro pits on June 20, 1985. The

results of the chemical analyses of these samples are in Appendix ____.

The water in the pits is used by Brush Wellman for dust control on mine roads. Water trucks equipped with sprayers will be used for water application both by stripping contractors and by Brush Wellman mine crews engaged in final stripping and ore removal. The only other use of pit water is by wildlife, principally antelope, birds, and small mammals, and sheep. Sheepherders pump water from the pits and use it for watering their stock.

The pit water is preferred by sheepherders to the local groundwater for livestock watering. The well located in Section 31, T.12S., R.12W. and owned by the B.L.M. is no longer in use or functional. This well and Brush Wellman's water well penetrate the local water table aquifer. This aquifer is quite saline and is not usable for drinking water. In fact, drinking water is hauled to the mine from Brush's Delta Mill. In contrast, as the water quality data in Appendix ____ demonstrate, the water in the mine pits is of good quality. It was noted during preparation of this reclamation plan that the chukar partridge and antelope populations in the mine area have been enhanced by the availability of the water in the mine pits.

3.0 Hydrology and Runoff Control Plan

3.1 Site Hydrology

The Topaz Mining Property intercepts runoff from several small watersheds which drain the southwest slopes of Spor Mountain (see Plate 3.1-1). Some runoff currently flows through channels which are blocked by mine dumps. The water is stored behind these dumps until it evaporates or percolates into the alluvium or into the dump face. Some runoff drains into pits, and at least one channel currently passes though the mine site. Very little runoff leaves the mine site even when flow is not captured by the dumps or pits due to the infiltration capacity of the alluvial slopes on which the mine site is located.

The proposed Section 16 South #2 Pit and adjacent dump will be located in the channels of two large watersheds which drain part of the Thomas Range to the east of the mine property. Two other proposed dumps, adjacent to the Monitor and Camp Pits will be located downstream of existing pits and dumps and therefore will intercept runoff from very small contributing areas. Elevations of the contributing watersheds range from about 4800 feet at the mine site to 6690 feet in the Thomas Range. Vegetation and soil characteristics used in the determination of rainfall-

runoff relationship of the mine site and adjacent areas were described in Sections 1.3 and 1.4. The two major plant communities found at the site are a foothill shrub/grass community on shallow, rocky, gravelly, clay loam, and the alluvial slopes shrub/grass-forb community on deep gravelly loams. The higher elevations of some watersheds are located beyond the area of the baseline soils and vegetation studies; for the purpose of determining runoff characteristics, the areas above 6000 feet are categorized as juniper-grass sites with shallow, rocky soils similar to the foothill sites and with a significant amount of rock outcrop.

3.2 Rainfall and Runoff Characteristics

The Soil Conservation Service (SCS) Curve Number Method (SCS, 1972) was used to determine runoff volumes and peak flows for all of the drainage areas shown on Plate 3.1-1. Peak flows were calculated using a modification of the computer program developed by Hawkins and Marshall (1980) which uses the SCS Curve Number unit hydrograph method. The modified program allows use of the SCS Type II rainfall distribution. The storm events chosen for use in the design of the runoff control plan are the 50-year, 24-hour rainfall for diversion sizing and the 100-year, 24-hour rainfall for impoundment sizing. These rainfall amounts are 2.30 and 2.65 inches, respectively (Miller, et al, 1973). Runoff

volumes and peak flows for these events are shown in the table on Plate 3.1-1, as well as watershed characteristics used as input to the computer program. Details on the derivations of Curve Numbers and other related worksheets can be found in Appendix II. SCS Type II 24-hour rainfall distributions were assumed for both storm events.

Sediment yield was also predicted for drainage areas where water will be impounded. The PSIAC methodology (Pacific Southwest Interagency Committee, 1968), was used to calculate a sediment yield of 0.4 acre-feet per square mile. Details on this calculation can be found in Appendix II.

3.3 Runoff Control Plan

The runoff control plan for the property is comprised of two types of features: impoundments and diversions. These features are shown on Plate 3.1-1. Dumps which span a drainage channel and pits which intercept runoff will serve as impoundments for several small drainages. For larger drainages with higher runoff volumes, or for areas behind dumps with insufficient capacity to store runoff, diversion ditches will be placed to carry the storm runoff through the mine site. These features should minimize negative impacts of runoff and erosion both on- or off-site.

3.4 Impoundments

The runoff control plan proposes the use of eight impoundments where water will be stored behind existing dumps. These impoundments will intercept runoff from drainage areas B, D, H, K, L, M, and N. This will involve no changes to existing dumps or channels; runoff is currently adequately controlled using these features. To assure that the dumps will provide adequate control during future storm events, the following "design" standards were considered: the impoundment must be able to store the 100-year, 24-hour runoff volume, it must have at least a fifty year sediment capacity, and it must not be required to store more than 20 acre-feet of water from the design storm. In cases where the above conditions could not be met, diversion structures are proposed as the method of control.

Plate 3.1-1 shows the location of these impoundments. Plates 3.4-1 and 3.4-2 contain additional information on them. As can be seen from the table on these plates, most dumps have a significant amount of excess storage capacity beyond what is required. In addition, water stored behind these dumps is expected to infiltrate or evaporate quickly. The evaporation rate at the mine site is expected to be similar to the evaporation at nearby Fish Springs of approximately 77 inches per year (Utah Department of Natural Resources, 1978). Permeability of the dumps has not been

porous. The alluvial channels and slopes where the dumps are located are quite permeable. Runoff from the upper drainages often infiltrates soon after leaving the foothills and channels become very small and poorly defined. However, calculations of required impoundment capacities assumed that no infiltration would take place. Therefore, the actual amount of water which will be stored behind these dumps is probably significantly less than the design amounts.

There are three dumps which will not adequately contain the design runoff. At impoundment area D, a channel is located at the elevation necessary to divert any runoff in excess of 20 acre-feet. At impoundment area H, the excess runoff will flow south in the diversion channel designed to carry flow from both drainage area H and J. At impoundment area M, the excess runoff will flow west to the impoundment at area L, which has adequate capacity to handle this additional volume.

The dumps that impound drainages have been shown to have adequate capacity to contain the design flows. These impounding features will not be removed from the drainages during reclamation. Therefore, because the dumps meet the appropriate hydrologic storage requirements, a variance from

Rule M-10 (8) is requested.

All runoff from areas C and F will flow into large open pits. These pits have adequate capacity to contain the design flows with a large safety factor.

3.5 Diversions

In areas where it was not practical to store water, either due to runoff amounts or dump capacities, diversion were designed to convey runoff from the site. The locations of the 7 diversions that will be part of the runoff control plan are shown on Plate 3.1-1; design details are shown on Plates 3.4-3 through 3.4-5. Drainage areas which will be controlled by these diversions are: A, D, E, G, I, J, O, and P. All of these ditches were designed to safely pass the 50-year, 24-hour storm event with adequate freeboard.

Diversions at A, E, I, and J are basically natural diversions. Their shape will be an asymmetric triangle where the steeper slope is made up of the upstream toe of the dump face, and the shallower slope is the natural ground surface perpendicular to the dump face. The dump face will be composed of very coarse rhyolite rock. Flow will be routed along the dump face and then be released. Velocities during the design event will be non-erosive, as can be seen in the diversion characteristics presented on the plates.

The permeabilities of both the dump face and the natural ground were ignored in the design; in reality, peak flows during the design event should be much less than the design amount since permeabilities of the channel area are quite high. Minor variations in the topography along these diversions were ignored in the designs. These areas may provide very small storage areas which were considered insignificant and their exclusion from the design provides an additional degree of conservatism.

The diversion at area D is designed at an elevation such that the dump cannot impound more than 20 acre-feet of water. This diversion will be trapezoidal in shape, with 1h:1v side slopes and an 8-foot bottom width. Riprap with a d50 of 1.0 foot will be placed to a depth of 3 feet in the channel. This diversion will carry flow around the dump and to natural ground downstream of the dump.

The diversion at area G will carry runoff around the dump and to natural ground downstream of the dump. The upper and lower reach of this channel will be an asymmetric triangular channel where the steeper slope is a dump berm (see section 5.0, Sediment Control, for description of dump berms) and the shallower slope is natural ground. The middle reach of the channel is a trapezoidal channel where the bottom is comprised of a compacted gravel road bed, the steeper side

slope is a dump berm, and the shallow slope is natural ground.

The diversion for areas O and P will be a bermed channel with check dams to lower the gradient. The upper reach of the diversion will use the dump toe as the right berm, and the left berm will be constructed out of the rhyolite dump material. The lower reach will have both berms constructed out of the dump material. The channel bottom will be the natural soil material, with the exception of an apron below the check dams. The seven check dams will be constructed out of the rhyolite. Channel alignment is such that the runoff will empty back into the same drainage channel it will be diverted from.

References

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4.0 Reclamation Program

4.1 Post-mining Land Use

The declared post-mining land use will be livestock grazing and limited wildlife habitat. The wildlife currently benefit from the water stored in the pits and upstream of the dumps.

4.2 Test Plots

A revegetation test plot program was commenced at the mine in 1978. The results of this work have been analyzed for incorporation in the reclamation design proposed herein and no new test plot programs are contemplated. The proposed methods for reclamation will be applied during the course of mining. The experience gained from revegetating existing and proposed sites with the revised revegetation techniques contained herein will provide over the next 30 years the data necessary to develop the best possible revegetation program.

4.3 Soils Handling and Soils Balance

The alluvial soils, where they occur and within the amounts reasonably available, will be stripped from future pit and dump sites prior to mining. Only the alluvial soils have suitable physical properties and availability to provide a topsoil resource. As shown on Plate 4.3-1, much of the mine plan area is underlain by stony soils that are not a topsoil

resource and therefore will not be stockpiled prior to mining. Plate 4-3.2, Topsoil Borrow and Redistribution Map, shows the borrow sites and dumps and back-filled pits onto which topsoil will be redistributed.

The alluvial soil that is stripped will be stockpiled in designated areas adjacent to the pits and dumps. These areas will be located at the time of topsoil stripping and will be selected to minimize erosion of the topsoil pile as well as impacts from mining operations. The topsoil piles will be constructed with 3h:1v side slopes and they will be reseeded with grasses and legumes in the first full season following their construction.

The handling of mine waste rock and topsoil has been carefully planned to allow the best use of topsoil borrow material. ~~and~~, In cases where topsoil is not available, coarse, blocky rhyolite ^{will be used} as seedbed for revegetation and cover medium, respectively. The placement of these materials on mine dumps and backfilled pits is described below and summarized in Table 4.3-1. Plate 4-3.3, Pit Complexes and Reclamation Treatments, shows the reclamation treatments planned for all pits and backfilled dumps.

The mine overburden material, consisting of rhyolite, altered rhyolite and volcanic tuff will be placed in the

Table 4.3-1 Soil Balance

PIT	PRE-MINING SOIL BORROW YIELD ACRES X DEPTH(FT) = SOIL VOL. (CY)		DUMP TOPSOIL COVER DEMAND (1) ACRES X DEPTH(FT) = SOIL VOL. (CY)		ROCK BACKFILL OR SOIL COVER FOR PIT ACRES X DEPTH(FT) = ROCK VOL. (CY)	
Roadside/Fluro Pit	16.53 11.25 Subtotal	3.0 1.0 98,155	80,005 18,150 98,155	N/A	5.95 39.68	28,808 (rock) 96,025 (soil)
Fluro Pit		N/A	N/A	N/A	1.73	8,340 (rock)
Section 16 Pit	58.19	2.65	248,687	18.0 * 46.95 ** Subtotal	3.0 1.5 200,739	87,120 113,619 200,739
Monitor Pit	68.76	3.0	332,798	20.6 * 84.14 ** Subtotal	3.0 1.5 303,323	99,704 203,619 303,323
Camp Pit	17.05	4.0	103,152	7.6 * 26.82 ** Subtotal	3.0 1.5 103,688	36,784 64,904 103,688
Southwind Pit	24.24	3.1	119,335	9.8 * 29.68 ** Subtotal	3.0 1.5 119,355	47,529 71,826 119,355
Blue Chalk North Pits			N/A	N/A	4.53	21,940 (rock)
Blue Chalk South Pits			N/A	N/A	4.46	21,562 (rock)
Rainbow Pits			N/A	N/A	5.23	25,308 (rock)

(1) Acreages include adjustments for slopes.

* acreage of ore pad portion of dump

** acreage of remainder of dump top and side slopes

dump sites adjacent to the pits. These materials will be placed so the rhyolite waste rock will cover the 1h:1v dump slopes and the tuff material will cover a portion of the top surface to provide a smooth uniform base for ore stockpiles (see Figure 4.3-1). This smooth top surface of the dumps produced with the veneer of tuff (approximately 25% of the dump top) serve as ore pads for handling and inventorying the beryllium bearing-ore.

The dump outslopes have been constructed with 1h:1v outslopes since inception of mining in 1968. During the nearly 20 years of continuous mining operations at the Topaz Mining Property, there have been no occurrences of slope failures resulting from mass instability. The pit outslopes are dominated by blocky rhyolite which promotes slope stability. The control of erosion on certain pit outslopes is discussed below in Section 5.0. The current and historic slope conditions and the erosion control measures that will be taken provide that safety hazards and erosion are minimized.

Brush Wellman requests a variance from Rule M-10 (4) for rounding of the dump margins. Rounding of the dump margins would prevent the installation of dump-top berms which are used to control runoff to the outslopes, thereby minimizing dump slope erosion.

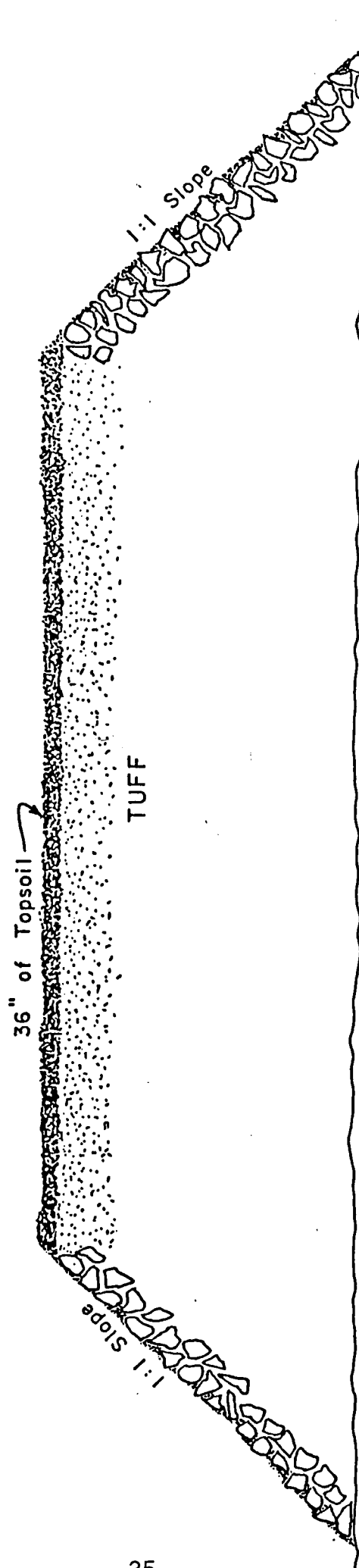


Figure 4.3-1
Topsoiled Dumps with Tuff-Covered Top

Upon completion of the ore mining and shipping, the future, tuff-covered ore pads will be topsoiled with a 36-inch layer of topsoil from the stored alluvial soils. This soil depth would reasonably separate the revegetated cover from the affects of the deleterious salts present in the tuff (see attached report: Report on Investigations of Soils, Brush Wellman Inc., Topaz Mining Property, JBR, 1985). The remainder of the dump tops will consist of rhyolite rock (Figure 4.3-2). This rhyolite surface on the tops and slopes of future dumps will be topsoiled to an average depth of 18 inches utilizing stored alluvial soils, ^{where available} The topsoil would essentially fill in the cavities among the rocks with some of the larger rocks protruding above the soil surface. The dump tops would receive priority over the slopes should topsoil volumes be limited at any future site. **Dumps receiving topsoil cover are shown on Plate 4.3-3.**

Some previously mined pits will be backfilled with overburden during future mining operations in adjacent pits. Table 4.3-2, Pit Backfill Schedule and Acreage, and Plate 4.3-3 describe the details of the pit backfill plans. The pit backfill areas will not be topsoiled, but will be surfaced with coarse rhyolite rock. The exceptions are portions of Roadside I&II and Section 16 N #1 which will have 18 inches of topsoil over the rough rhyolite backfill. All tuff overburden disposed of in the backfilled pits will

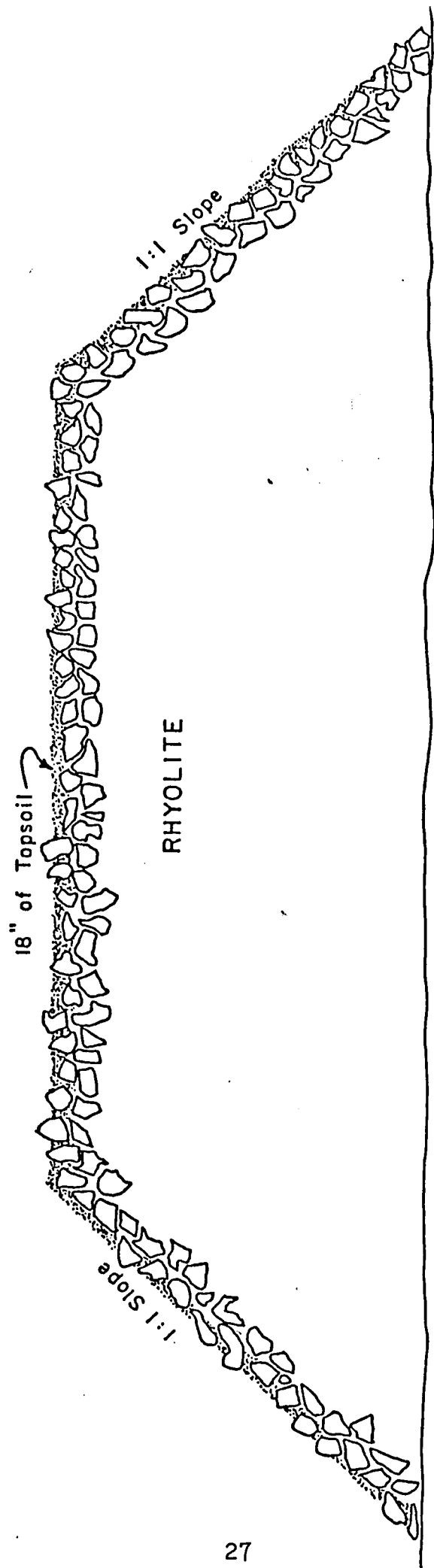


Figure 4.3-2
Trenched Dumps With Rhyolite - Covered Top

Table 4.3-2 Pit Backfill Schedule and Acreage

<u>Pit Complex</u>	<u>Source</u>	<u>Recipient</u>	<u>Acreage</u>	<u>Year Scheduled</u>
Roadside/Fluro #3		Roadside I & II	39.68	1992/2005
Fluro	#2	#1(part)	11.50	2008
Rainbow	#2	#1	16.53	1998
	#3	#1	18.33	2013
Blue Chalk South	#2	#1	14.85	1994
	#3	#1	14.85	2018
Blue Chalk North	#2	#1	19.57	2002
	#3	#2	10.65	2014
Section 16	South #1, North #3	North #1,#2	17.98	2010

Figure 4.3-3 and Plate 4.3-2 depict backfilling and reclamation techniques.

be placed in tuff disposal cells or pockets that will be left for this purpose during backfilling. Brush's mining experience indicates that such cells will take up no more than 15 percent of the surface area of any backfilled pit. The surface of each cell or pocket will be covered with 3 feet of rhyolite overburden. This will be accomplished by selectively piling rhyolite adjacent to the tuff disposal cells so the rhyolite can then be pushed over the tuff with a bulldozer (Figure 4.3-3). In all cases there is an adequate supply of rhyolite in each pit complex.

Rhyolite

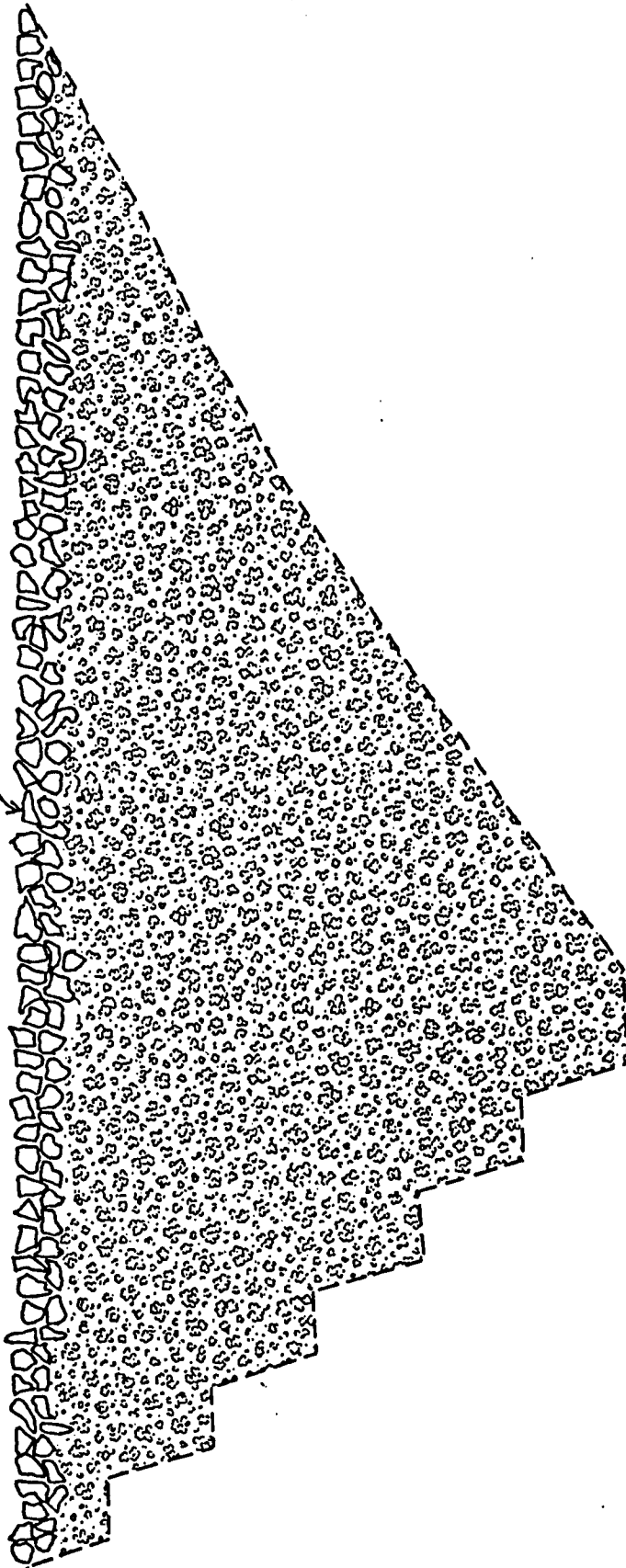


Figure 4.3-3

Many pits will be left open either to provide access for future underground mining, or because backfill material is not available from adjacent pits. Underground mining for the ore remaining after exhaustion of the shallow ore deposits by surface mining will depend on economic conditions in 2034. The future pits to remain open as access for underground mining are: Monitor #1,#2,#3; Roadside/Fluro #3, Rainbow #2 and the North portion of Fluro #1 and Fluro #2. *Two existing James* ~~one pits~~ the Sigma Emma, and seven proposed pits (Camp #1, Southwind #1, Blue Chalk North #3, Blue Chalk South #2 and Section 16 South #1) will be left open because they will be mined at the end of the mining cycle and backfill material will not be available.

The mine pits will have stable, terraced highwalls of rhyolite and stable footwalls of tuff. Figure 4.3-4 provides a typical pit cross-section showing these features. The walls of the open pits have been generally stable throughout the history of mining at the Topaz Mining Property. The high walls, which consist of hard rhyolite, are benched in accordance with U.S. Mine Safety and Health Administration (MSHA) regulations. The footwall tuff slopes are not steep enough to require benching for stability. Slope failures have only been encountered in association with inactive faults scarps that are exposed during mining. The most common occurrences of failure take place at fault

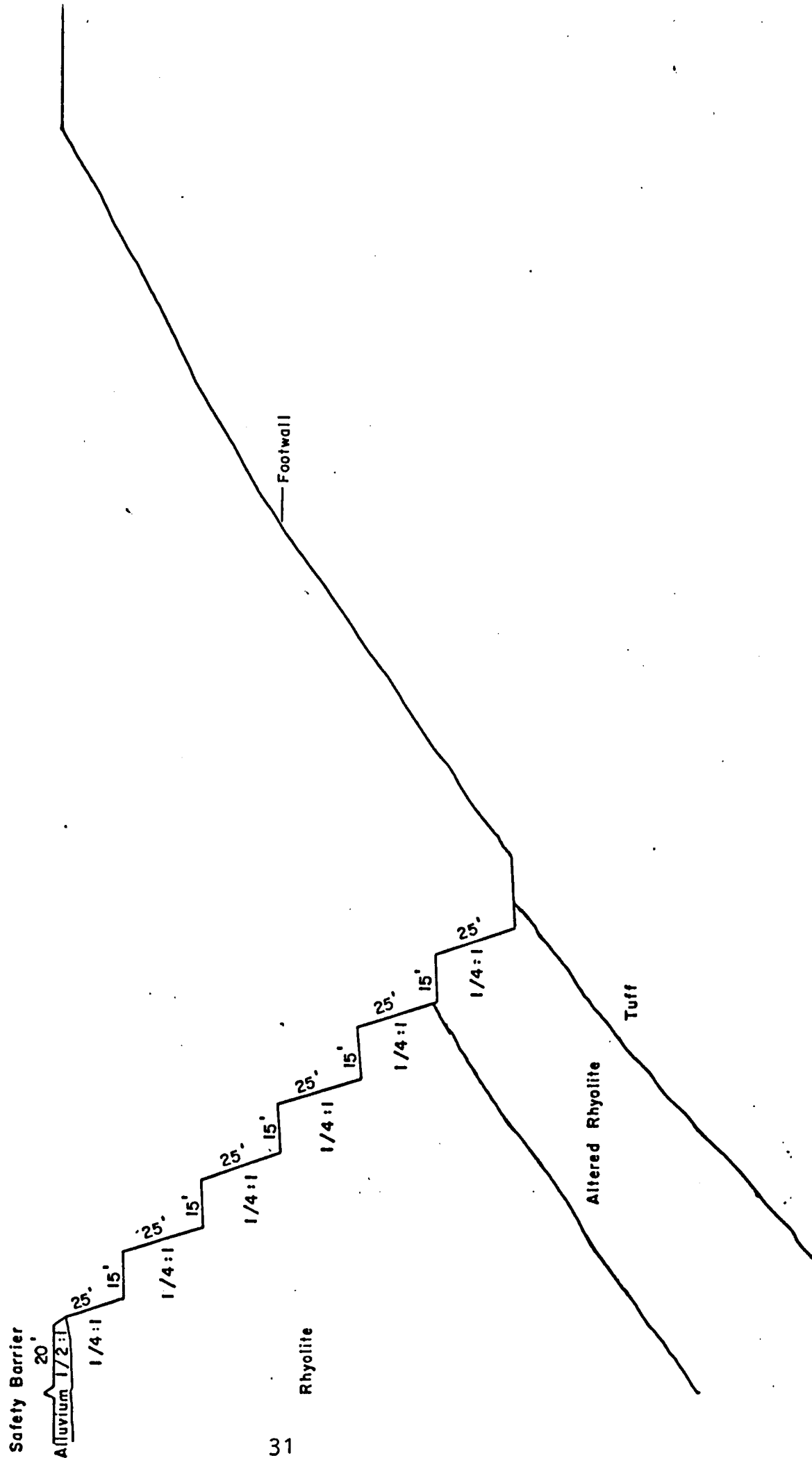


Figure 4.3-4
Typical Pit Cross - Section

intersections. These failures are stabilized during mining to achieve compliance with MSHA safety requirements. Major slope failures during the post-mining period are not anticipated.

Brush Wellman requests a variance from rule M-10 (5), which addresses open pit reclamation, for the following reasons:

- (1) it is not economically feasible or necessary to reduce pit outslopes to 45° or less for reasons of safety;
- (2) the need for possible future access for underground mine development makes filling of most pits impossible;
- (3) in the case of the Taurus pit, no further open pit mining is planned in the area, therefore backfill material is not available;
- (4) the proposed Camp #1, Southwind #1, Blue Chalk North #3, Blue Chalk South #2 & #3, and Section 16 South #1 and #2 will be mined at the end of the mining cycle and backfill will not be available; and
- (4) as the foregoing discussion demonstrates, pit walls are stable following completion of mining and Brush's mining experience indicates that they will continue to be stable during the post-reclamation period.

The thin, stony soils in the eastern hilly portion of the property do not provide any salvageable topsoil; As shown

However should salvageable soil be encountered during overburden removal, they will be salvaged.

on Plate 4.3-1, future mine pit development in the hills will not be preceded by topsoil stripping. Those pits not mined at the end of the mining cycle or left open for future underground mining will be backfilled as shown on Plate 4.3-2. Since there can be no topsoil recovery in the area, the backfilled pit surfaces will not be topsoiled.

A variance from Rule M-10 (14) is requested to allow the backfilled pits designated Fluro #1, Rainbow #1, Blue Chalk North #1 & #2, and Blue Chalk South #2 ^{and not topsoiled} to be covered with non-eroding, blocky rhyolite and not topsoiled. This variance request is, as stated above, sought because salvageable topsoil does not occur at these pit locations.

Treatments for these dumps to minimize off-site impacts are discussed in the 5.0 Sediment Control section.

4.3.1 Roadside/Fluro Pits

The development of the Roadside/Fluro #3 and #4 and the Fluro #2 pits will result in the disturbance of 55.64 acres of previously undisturbed land surface (Plate 2.0-1). Approximately 27.78 acres of this area is underlain by alluvial soils. The stripping of 3 feet of available alluvial soils on 16.53 acres and 1 foot of available alluvial soils on 11.25 acres will provide approximately 98,155 cubic yards of topsoil. The remaining surface acreage

of these pits sites are underlain by rhyolite with little or no soil.

Rhyolite overburden from the pits will be spread over the existing Fluro dump covering all the presently exposed tuff and altered rhyolite on the dump top and slopes. The altered rhyolite and tuff overburden from these new pits will be placed in a tuff disposal cell in the Roadside I&II pits. The surface of this cell will occupy no more than 15 percent of the 39.68 dump surface. The cell will be covered with a minimum of 3 feet of rhyolite after it is filled. The rhyolite required for backfill will be 28,808 cubic yards and will be stockpiled adjacent to the cell.

The backfilled pit will be covered with topsoil and seeded. This will require 96,025 cubic yards of topsoil leaving an excess of 2,130 cubic yards of topsoil. This is a negligible amount and will be spread over the pit while topsoiling. The rhyolite-covered slopes of the old Fluro dump will be seeded with rabbitbrush.

4.3.2 Section 16 Pits

The pits in the Section 16 complex are designated North #1, #2 and #3 and South #1 and #2. The proposed pit area is over thin, stony soil on a rocky ridge and topsoil.

Approximately 58.19 acres of the 70.95 acre dump site is over alluvial soil and will be stripped to an average depth of 2.65' providing 248,687 cubic yards of topsoil for stockpiling (Plates 2.0-1 and 4.3-1).

The overburden from South #1 and North #3 pits will be placed as backfill in the North #1 and #2 pits. This overburden will be placed so the rhyolite will cover the 17.88 acre surface. The overburden from North #1 and #2 and South #2 will be placed on the dump so the rhyolite covers the slopes and top except for an 18 acre ore pad.

The 18 acres of ore pad will be topsoiled 3 feet deep with 87,120 cubic yards of topsoil. The remaining rhyolite-covered dump top and slopes will be topsoiled with 113,619 cubic yards (Table 4.3-1) of alluvial soils and seeded. The rhyolite-covered backfilled pits will be covered with 18 inches of topsoil (43,269 cubic yards) and seeded with rabbitbrush.

The total topsoiling will require 244,009 cubic yards of soil leaving an excess of 4,678 cubic yards (Table 4.3-1). This is a negligible amount and will be spread with the bulk of the topsoil.

4.3.3 Monitor Pit

The Monitor complex consists of four pits, Pits # 1, #2, #3, totalling 68.76 acres. Pit #1 includes a small 6.89 acre existing pit originally excavated by Anaconda Minerals Company (Plate 2.0-1). The 82.46 acre dump is located over the existing small dump generated by Anaconda's past operation. The pits are located over minor stony soil areas and alluvial soil areas. During pit construction, the alluvial soils will be stripped to an average depth of 3 feet producing 332,798 cubic yards of topsoil to be stockpiled.

The top and slopes of the dump will be covered with rhyolite overburden except for a 20.6 acre ore pad on the dump top. The 20.6 acre ore pad of tuff material will be topsoiled 3 feet deep with 99,704 cubic yards of alluvial soils and seeded. The rhyolite-covered dumps will be topsoiled with 203,619 cubic yards of alluvial soils and seeded.

The total requirement for topsoil is 303,323 cubic yards. This leaves an excess of 29,475 cubic yards of topsoil which will be spread with the rest of the topsoils (Table 4.3-1).

4.3.4 Camp Pit

The Camp Pit #1 of 17.05 acres and the 30.45 acre dump are located over alluvial soils on the valley slopes (Plate 2.0-1). The pit site will be stripped of alluvial soils to a depth of 4 feet and 103,152 cubic yards of soils stockpiled.

All of the overburden materials from the pit will be placed in the dump. The overburden will be placed so the rhyolite rock covers the top and slopes of the dump except for a 7.6 acre ore pad on the top.

The tuff material of the ore pad will be topsoiled to depth of 3 feet and seeded. This will require 36,784 cubic yards of topsoil. The remaining rhyolite-covered dump will be topsoiled with 64,904 cubic yards of soil and seeded.

The topsoiling will require 103,688 cubic yards of material. There will be a 536 cubic yard deficiency, a negligible amount (Table 4.3-1).

4.3.5 Southwind Pit

The development of Southwind Pit #1 will disturb 24.24 acres of new land surface on the valley slopes (Plate 2.0-1). The new dump will cover 39.28 acres of the valley slope. The alluvial soils will be stripped from the pit site to a depth

of 3.1 feet to provide 119,335 cubic yards of topsoil for stockpiling.

All of the overburden from the pit will be placed in the dump. The tuff and altered rhyolite overburden materials will be placed in the interior of the dump with the rhyolite overburden placed to cover the top and slopes of the dump. The 9.8 acre ore pad will be built of tuff materials on the top of the dump.

The ore pad will be covered with 3 feet of topsoil requiring 47,529 cubic yards of soils. The remaining rhyolite-covered dump top and slopes will be covered with soil. This will require 71,826 cubic yards of soils. The total volume of topsoil required is 119,355 cubic yards (Table 4.3-1).

4.3.6 Fluro Pit

The future mining in the Fluro #2 Pit will disturb 19.10 acres of new land surface (Plate 2.0-1). A portion of the overburden from this pit will be placed in an 11.5 acre south portion of the existing Fluro pit. To allow for the possible disposal of tuff overburden on the dump surface, a pocket will be left in the backfill. This pocket will have a surface area that will not exceed 15 percent of the pit backfill surface. A ^{ore waste} {stock pile} of 8,340 cubic yards of rhyolite will be stored adjacent to the tuff disposal pocket

to be used to cover the cell when it is filled (table 4.3-1). The balance of the Fluro pits must remain open to provide access for possible future underground mining.

4.3.7 Blue Chalk North Pits

The Blue Chalk North complex consists of an existing pit (#1) and two proposed pits (#2)(Plate 2.0-1). The future mining in the Blue Chalk North pits will result in backfilling the #1 and #2 pits. The Blue Chalk North site is located in the hills where no topsoil is available.

Approximately 15 percent of the 30.22 acres of backfilled pits may be used as disposal cells for tuff overburden. These cells will be covered with 3 feet of rhyolite. A total volume of 21,940 cubic yards of rhyolite from the overburden in pits #2 and #3 will be piled adjacent to the tuff disposal cells for this purpose (Table 4.3-1).

4.3.8 Blue Chalk South Pits

The Blue Chalk South complex consists of an existing pit (#1) and two proposed pits (#2)(Plate 2.0-1). The overburden removed from the Blue Chalk South pits #2 and #3 will be used to backfill the adjacent #1 pit. The Blue Chalk South site is located in the hills where no topsoil is available.

Again, no more than 15 percent of the 29.7 acres of the backfilled surface of the #1 pit will be the site of a tuff disposal cell which will be covered with 3 feet of rhyolite. As a result, 21,562 cubic yards of rhyolite will be stockpiled adjacent to the cell for this purpose (Table 4.3-1).

4.3.9 Rainbow Pits

Future mining in the Rainbow complex will result in backfilling the #1 pit with overburden from the #2 pits (Plate 2.0-1). The Rainbow site is located in the hills where topsoil is not available.

Of the 34.86 acres of this backfilled pit surface, no more than 15 percent will be taken up by the surface of the tuff disposal cell. This cell will be covered with 3 feet of rhyolite after it has been filled. This will require that 25,308 cubic yards of rhyolite be stored adjacent to the cell for this purpose (Table 4.3-1).

4.4 Reclamation of Sanitary Landfill

Brush Wellman use an on-site sanitary landfill for disposal of solid wastes. The landfill is located within the southeast quarter of the southeast quarter of Section 5, T.13S, R.12W. on top of the Roadside dump. A permit for the landfill was issued by the Utah Bureau of Solid and

Hazardous Waste on August 12, 1985. A copy of the permit and the permit application is included as Appendix _____. The application includes a description of the operation of the landfill and a location map.

Upon reaching capacity, the landfill will be reclaimed by covering with tuff material excavated to form the landfill disposal cells.

4.5 Reclamation of Roads

The roads and ways that existed prior to Brush's mining will be left to provide access to other mines and sheep bed grounds (Plate 2.2-1). Roads to be reclaimed will be ripped to relieve compaction and improve water carrying capacity. The roadbed will then be scarified followed by application of seed, fertilizer and mulch spread by broadcasting. The seedbed will then be back-dragged to cover and anchor the seed, fertilizer and mulch. Water bars will be installed on a few sites where grades are such that runoff may cause excessive erosion. A few roads cross natural, ephemeral drainages. The drainage crossings will be regraded so that drainages are not restricted by road fill or impaired in any other manner.

The total acreage of roadbeds to be treated is 12.8 acres. Table 4.4-1 shows the lengths of roads to be reclaimed in

4-5-1

each pit complex area. The locations of these roads are indicated on Plate 2.2-1, Road System map. As this map demonstrates, most roads will be left for continuing use following reclamation.

4.6 Revegetation

The topsoil will be spread with scrapers leaving a rough topsoil surface. Seed and fertilizer will be spread on the soil utilizing broadcast methods. Mulch will then be spread and the loose soil back-dragged with a chain to cover and anchor the mulch, seed and fertilizer.

4.5-1

Table 4.4-1 Roads to be Reclaimed

Pit Complex	# of Roads	Length
Taurus	2	1,600'
Sigma Emma	2	3,000'
Roadside I&II	1	2,800' 1,500'
Rainbow	4	6,000'
Blue Chalk South	1	2,000'
Rainbow-Blue Chalk	1	1,000'
Fluro	1	500'
Total	13	16,900'

The mine camps will be dismantled at the conclusion of mining. The structures (mobile homes, shop buildings and utilities) will be removed. The concrete slabs will be removed and disposed of on-site.

The seed selection for reseeding the topsoil-surfaced sites is based on the previous test plot results, the species present in the baseline plant communities and observations of plants colonizing disturbed sites. The recommended revegetation seed mix is shown in Table 4.4-2. Crested wheatgrass, squirreltail and green rabbitbrush have been the most successful of all the desirable plants in colonizing disturbed sites. The other shrubs and grasses in the seed mix are important components of the plant communities. Yellow sweetclover has persisted from the test plot seedings and also is included because it is a legume.

Since the soils are high in sodium, the CaCO_3 will be added to provide a source of Ca^{++} which will tend to replace the Na^{++} in the alluvial soils.

The existing and future rhyolite-surfaced pit backfills or dumps will be seeded with rabbitbrush (*Chrysothamnus nauseosus*). This will be broadcast at the rate of 3 lbs/acre ~~(XLS)~~. The seed that becomes lodged in the crevices and low spots will eventually receive a thin covering of soil from

air-transported dust. This coupled with moisture from precipitation will provide the environment for germination. This situation has been noted on other rhyolite dumps where

Table 4.4-2 Seed Mix

Scientific Name	Common Name	^{APW} lbs./acre
Agropyron cristatum	crested wheatgrass	3.0
Sitanion hystrix	squirreltail	2.0
Oryzopsis hymenoides	Indian ricegrass	2.0
Sporobolus cryptandrus	sand dropseed	0.5
Melilotus officinalis	yellow sweetclover	1.0
Penstemon palmeri	Palmer's penstemon	1.0
Atriplex canescens	four-wing saltbush	1.0
Ceratoides lanata	winterfat	1.0
Chrysothamnus viscidiflorus	green rabbitbrush	1.0
Total		<u>12.5</u>

Mulch: Hay or Straw at 4,000 lbs./acre

Fertilizer:

sulfur-coated urea, 39-0-0 10%S, at 128 lbs./acre

superphosphate, 0-48-0, at 200 lbs./acre

lime, ~~CaCO₃~~ 20%Ca, at 350 lbs./acre

Lysium

respectable stands of rabbitbrush have become established in a relatively short period of time(Appendix II). This seeding technique will attempt to emulate the native colonization but is not expected to satisfy the 70% rule for groundcover or diversity of the pre-mining plant communities as they are defined in the report on plant communities.

To accommodate the revegetation practice planned for the tuff- and rhyolite-covered dumps and backfilled pits, a variance from Rule M-10 (12) is requested. As the discussion in the Introduction to this plan demonstrates, the existing dump surfaces were, at the suggestion of Division staff, covered with tuff which was thought, based on its texture, to be a potential soil substitute for revegetation. Based on a test plot program and chemical analyses, this material has since been determined to be chemically unsuitable for plant growth. Therefore, these dumps cannot be revegetated.

Some existing dump tops and outslopes and backfilled pit surfaces will be composed of blocky rhyolite because sufficient topsoil is not available to cover them. While the reclamation plan does call for seeding of the rhyolite with rabbitbrush, the requirements under rule M-10 (12) for diversity and achieving "a surface cover of at least 70% of the representative vegetative communities surrounding the

mine" cannot be met. In addition, the three (3)-year vegetative survival and distribution requirements may not be achievable and a waiver of these requirements under Rule M-10 (12) is also requested.

The topsoil storage piles will be seeded with a temporary seed mixture to preserve the microorganisms and protect the surfaces from wind and water erosion. This seed mixture will consist of crested wheatgrass, squirreltail, and yellow sweetclover broadcast at a rate of 2 lbs/acre for each species.

4.5 Monitoring

The long period of operation and concurrent reclamation will allow for continuous monitoring of each reclaimed site. The results of the inspection and maintenance of each site will be included in the annual report. When each site has been reclaimed in accordance with the monitoring criteria described below, a report and request for partial bond release will be submitted to the DOGM.

Monitoring Criteria:

1. The seedings on topsoiled sites, roads and camps will be checked with transects to determine species composition and percent ground cover. A successful three-year seeding will have a species diversity similar to and a ground cover equal

5.0 Sediment Control

Dumps

The primary source of sediment at the property is related to erosion of the tuff which covers most of the existing dumps. This material does not support vegetation because of its poor soil structure and chemistry. A complete discussion of this is found in the Report on Investigation of Soils, Brush Wellman, Inc., Topaz Mountain Property. The lack of vegetation and high clay content of this material causes almost all precipitation to run off of these surfaces which erodes the dump slopes.

To control sediment discharge from those existing dumps with tuff-covered slopes, berms will be constructed to catch these sediments and provide a seedbed for plant growth. See Plate 3 in the original Mine Plan for dump construction. The berm and borrow ditch will be seeded with the seed mixture, fertilized and mulched (as detailed under revegetation of topsoil) to establish some plant cover on the perimeter of the dump slopes (Fig. 5.1-1 & 5.1-2). This plant cover, at the toe of the slopes, could provide for the eventual plant colonization of the tuff slopes. This has occurred naturally in depressions on some of the older tuff slopes.

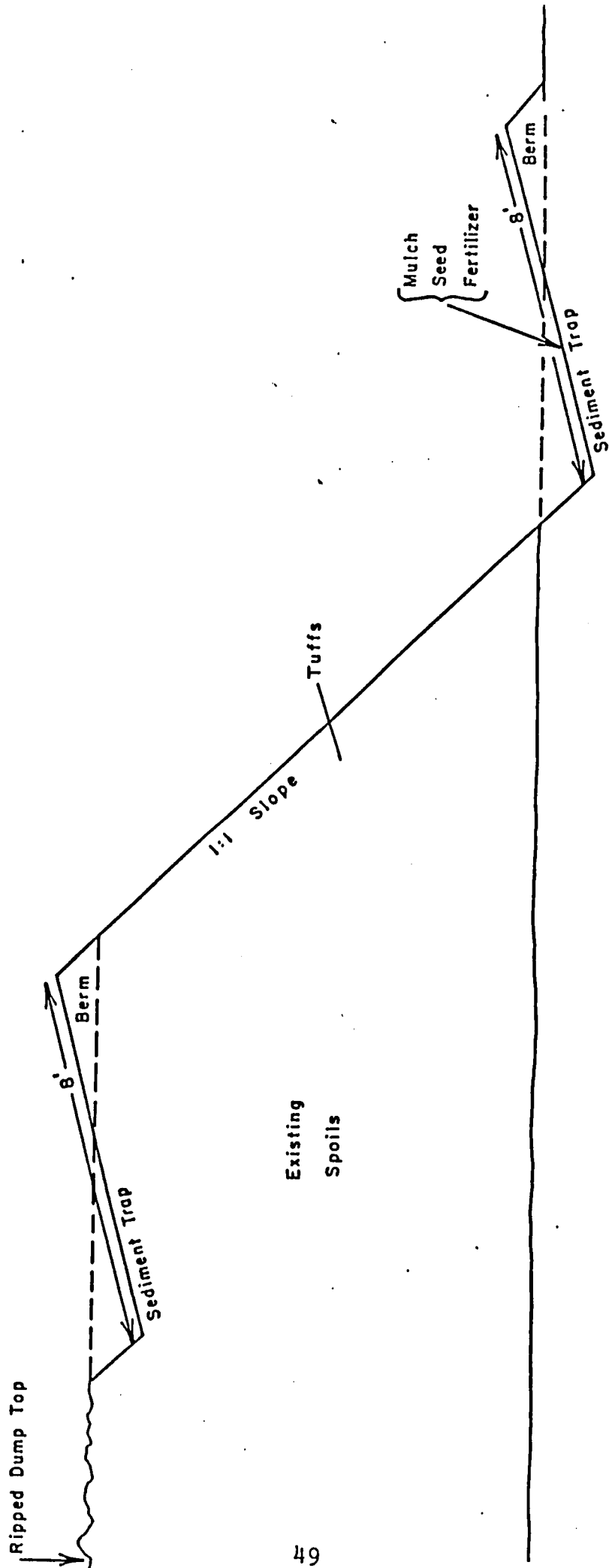


Figure 5.1-1
Dump Berm Construction

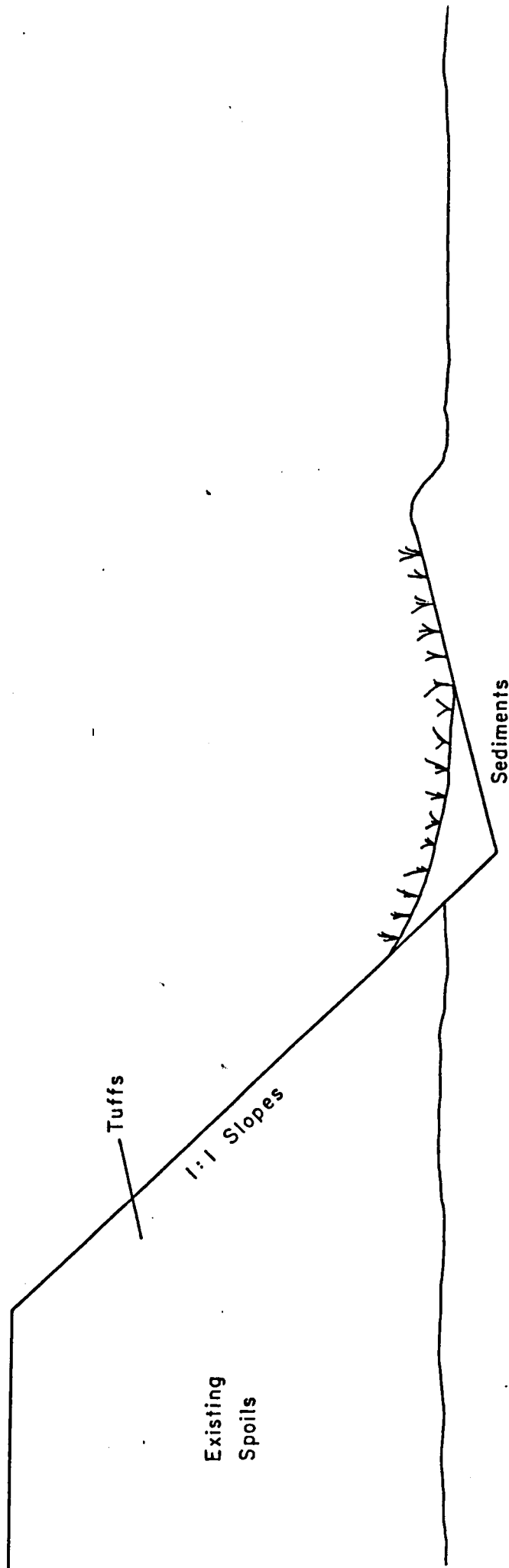


Figure 5.1-2
Mature Dump Berms

The berms will be located where sediments discharged from tuff-covered slopes can flow across the natural terrain. Berms will not be located where the terrain naturally traps the tuff sediments against the toe of the dump slopes. Dump berm locations are shown on Plate 4.3-2 Dump Berms. The dumps receiving berms and the berm lengths are shown on Table 5.1-1. Berms also are not located along slopes covered with rhyolite because their stability precludes sediment discharge. The berms are constructed by ripping the soil 36" deep and then making two passes with a grader to cut in the grade and form the berm.

Table 5.1-1 Dump Perimeter Berms

<u>Dump</u>	<u>Berm length in feet</u>
Sigma Emma	3,126
Roadside I&II	10 ⁷ ,596
Total	10 ¹⁰ ,722

The surface of those dumps that are tuff-covered will be ripped to 12" deep on the contour to facilitate adsorption of water and encourage the establishment of native vegetation in the furrows. In many situations, the ripping will expose rhyolite rock that is very porous. This will reduce runoff from the tops where presently the smooth hard

tuff surface seals off during precipitation events causing excessive surface flows that contribute to the gullyng of dump tuff slopes. The islands of vegetation that become established in the furrows will also help check surface flows. To further control runoff on the top edge of the tuff-covered dumps, berms, similar to those at the foot of the slopes, will be constructed on the top perimeters to contain the runoff originating on the dump tops (See Figure 5.1-1). Table 5.1-2 shows the dumps that will be treated by installation of dump-top berms and surface ripping.

Table 5.1-2 Dump Tops with Surface Ripping and Berms

Dumps	Berms ft(est.)	Acres to be Ripped
Sigma Emma	3,800	42
Roadside I&II	7,800	70
Blue Chalk	---	8
Total	11,600	120 112

In summary, the sediments from the tuff-covered dumps will be contained with berms at the toe of the dump slopes. These berms will capture tuff sediments and also moisture from the slopes. This increased moisture should aid in establishing plants on the berm and eventually on the slopes to help stabilize the slope surfaces. Additionally, the

ripping and use of perimeter berms on the dump tops will prevent surface runoff from discharging onto the slopes.

6.0 Safety

The open pits will have 4' high rock berms 20' back from the pit perimeter to deter access to the open pits (Plate 4.3-2). These stable structures of large angular rhyolite rock will remain as permanent barriers around each pit that remains open after operations has been completed (Table 6.1-1). Any pit that is backfilled, because of change in the operation schedule, will have the rock barrier removed and the rock debris become part of the backfill material.

Table 6.1-1 Pits with Rock Berms

<u>Pit</u>	<u>Rock Berm in Feet</u>
Taurus	1,750
Sigma Emma	5,600
Fluro, #2/Roadside #3,#4	3,720
Rainbow #2,#3	3,300
Blue Chalk, North #3	760
Blue Chalk, South #3	4,250
Section 16, South #1,#2, North #3	2,720
Monitor #1, #2, #3	5,450
Camp #1	3,050
Southwind #1	<u>3,550</u>
Total	34,150

7.0 Schedule

The schedule is based on Brush Wellman's, Inc tentative future mining plan. Generally the reclamation work will be undertaken on an annual basis. Thus the first reclamation work will be on pit complexes that have been mined and retired and then onto future mining sites as they are retired. Road and camp rehabilitation will generally be the last phase of the reclamation work.

Seeding will be done in the late fall or early winter. Since outside contractors who will at times be on the property conducting overburden stripping may also be used to place stockpiled topsoil on the dumps, the exact timing of topsoil placement may depend on the timing of stripping work. To the extent that circumstances allow, topsoil placement will be conducted during the three months prior to seed application.

Table 7.1-1 Reclamation Schedule and Timetable

Pit Complex or Site	Year	Time(days)	Jobs
Taurus	1987	3.5	dump berms
	1988 90	17.5	pit berms
	1988 89	2.0	roads seeded
Sigma Emma	1987 [1]	5.0	dump berms
	1988 90	56.0	pit berms
	1987 [1]	5.2	rip top of dump
	1988 89	4.0	roads seeded
Roadside I & II	1987 [1]	15.0	dump berms
	1987	9.0	rip top of dump
	1992	25.0	topsoil on backfilled pit
Blue Chalk North	1989 88	1.0	rip main - <i>chrysolite</i> covered portion of dump top
	1990	1.5	roads seeded
	2017*	1.5	rock on tuff disposal cell
	2018*	7.6	pit berm, roads seeded
Fluro	2008*	1.5	rock on tuff disposal cell
	2009*	1.0	roads seeded
	2009*	11.1	pit berm
Rainbow	2001*	1.5	rock on tuff disposal cell
	2013*	33.0	pit berm
	2014*	6.0	roads seeded
Blue Chalk South*	1998	1.5	rock on tuff disposal cell
	2018	42.5	pit berm
	2019	2.0	roads seeded
	2019	2.0	dump berm
Roadside/Fluro #3 & #4*	1989 90	12.0	pit berm
	2005	13.0	pit berm
	2010		roads seeded

[1] WORK completed

Table 7.1-1 Reclamation Schedule and Timetable con't.

Section 16*	2006	14.2	pit berm
	2010	12.0	pit berm
	2016	22.5	topsoil dump & pit
Monitor*	2017	54.5	pit berm
	2024	33.9	topsoil dump
Camp*	2021	30.5	pit berm
	2028	11.9	topsoil dump
Southwind*	2025	35.5	pit berm
	2032	13.7	topsoil dump
Mine camps and roads	2033-34	30.0	structural removal & sites+roads seeded

* Future mine pits and dumps

MINING AND RECLAMATION PLAN REVIEW
Brush Wellman, Inc.
Topaz Mining Property
ACT/023/003
Juab County, Utah

July 21, 1987

Rule M-3 - JRH

The operator has not yet incorporated all previous submittals into one document.

Rule M-3 (1)(d) - RPS

The applicant indicated that there exists no other water resources than those depicted on the existing mine plan maps during the meeting of May 18, 1987. This section is approvable.

Rule M-3 (1)(d) - DD

The operator has provided sufficient information in response to this comment.

Rule M-3 (1)(e) - RPS

As a result of the field tour conducted in July of 1987, it has been determined that the proposed drainage plan is acceptable and appropriate for the site and surrounding area conditions. Watersheds Brush.b, f, h, and i were selected for analysis as a representative sample for review. This analysis indicated that the applicant has correctly calculated the peak flows and expected runoff volumes for these watersheds. This section is approvable.

Rule M-3(2)(e) - LK

Previous comments requested the applicant to mulch all areas that are seeded and to anchor the mulch by crimping or using polypropylene netting in areas where crimping was not feasible. After the Division's site visit on July 7, 1987, it was determined that the dump slopes where there was considerable rock on the surface will not require mulch since those areas do not show signs of accelerated erosion and applying and anchoring the mulch would be impractical.

Rule M-3(2)(f) - LK

The Draft response adequately addresses comments under this section with regards to timing of revegetation activities.

Rule M-3 (h) - RPS

The applicant still needs to submit the water quality analysis for the high grade and low grade pits discussed in the August 1, 1985 response. Following analysis of those results, the Division will determine if a water monitoring program is needed for the site.

Rule M-5 Bonding Requirements - JRH

The company indicated that the detailed bonding estimate for the site would be submitted with the final reclamation plan. This should be provided to the Division in the next submittal. Permit approval cannot be accomplished until the operator provides a detailed plan for reclamation construction and a cost estimate.

Rule M-5 and M-10 Maps - JRH

The operator has not provided the maps as requested.

Rule M-10(2)(b) - JRH

The applicant has indicated that the disposal of waste materials will be in a sanitary landfill approved by the county. Brush Wellman has not provided a copy of the approval for the landfill with their reclamation plan. The operator has indicated that the approval will be included in the final submittal. Additionally, plans for the final reclamation of the landfill should be incorporated into the final reclamation plan.

Rule M-10(3) - JRH

Any pits or depressions left by the mining operations which are not self draining shall require the approval from Dam Safety, Department of Health and the Department of Wildlife Resources in order to achieve permit approval. Any impounding structures will have to address water quality and suitability for wildlife and/or grazing in the area. This information shall be incorporated into the mining and reclamation plan prior to approval by the Division.

Rule M-10(4) - JRH

The configuration of the slopes shown in the reclamation plan are such that the ridge lines of the waste piles are emphasized rather than rounded in order to blend in with the surrounding terrain. The operator has indicated that these ridges are intended to remain in order to affect suitable erosion control of the dumps. Stability analysis provided by the operator is based on past performance and operating procedures as approved by MSHA. The